US009461398B2

(12) **United States Patent**
Nakamura

(10) **Patent No.: US 9,461,398 B2**
(45) **Date of Patent: Oct. 4, 2016**

(54) **CONNECTOR**

(71) Applicant: **YAZAKI CORPORATION**, Minato-ku, Tokyo (JP)

(72) Inventor: **Masatoshi Nakamura**, Shizuoka (JP)

(73) Assignee: **YAZAKI CORPORATION**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/534,572**

(22) Filed: **Nov. 6, 2014**

(65) **Prior Publication Data**

US 2015/0064987 A1 Mar. 5, 2015

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2013/002272, filed on Apr. 2, 2013.

(30) **Foreign Application Priority Data**

May 10, 2012 (JP) 2012-108348

(51) **Int. Cl.**

H01R 13/432	(2006.01)
H01R 13/58	(2006.01)
H01R 12/58	(2011.01)
H01R 12/70	(2011.01)

(52) **U.S. Cl.**

CPC ***H01R 13/58*** (2013.01); ***H01R 12/585*** (2013.01); ***H01R 12/7064*** (2013.01)

(58) **Field of Classification Search**

CPC H01R 13/432; H01R 13/41
USPC 439/746, 872, 733.1
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

3,412,369 A * 11/1968 Benjamin Fox H01R 4/14 439/748
4,701,004 A * 10/1987 Yohn H01R 13/426 439/744
5,147,227 A * 9/1992 Yurko H01R 13/41 439/733.1

(Continued)

FOREIGN PATENT DOCUMENTS

EP 1482594 A1 12/2004
JP 2005-135794 A 5/2005

(Continued)

OTHER PUBLICATIONS

A Japanese office action issued on Jan. 5, 2016 in the counterpart Japanese patent application.

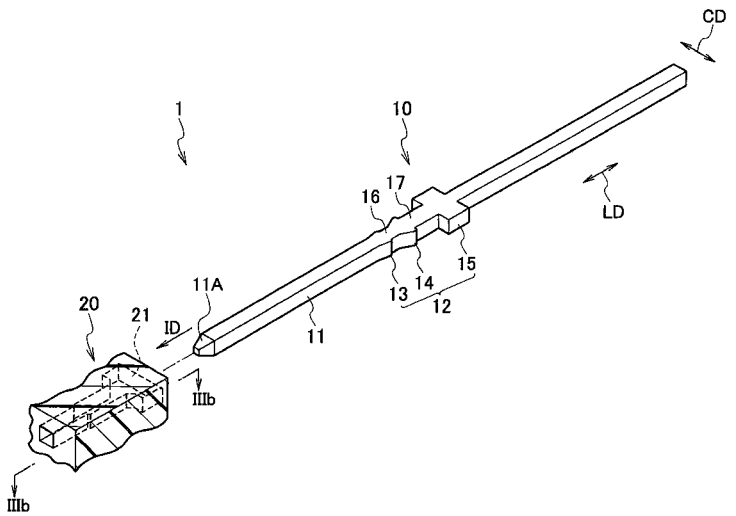
(Continued)

Primary Examiner — Abdullah Riyami
Assistant Examiner — Thang Nguyen
(74) *Attorney, Agent, or Firm* — Mots Law, PLLC

(57) **ABSTRACT**

A terminal includes a terminal body, and a press-fitting protrusion protruding from the terminal body in an orthogonal direction orthogonal to a longitudinal direction of the terminal to be press-fitted in the terminal holding hole. The press-fitting protrusion includes a first protrusion portion, and a second protrusion portion disposed rearward of the first protrusion in an insertion direction and protruding father in the orthogonal direction than the first protrusion portion. The terminal has, between the first protrusion portion and the second protrusion portion, a first connection portion having a width larger than a width of the terminal body.

20 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,389,013	A *	2/1995	Kourimsky	H01R 13/432 439/744
6,168,478	B1 *	1/2001	Daoud	H01R 4/2429 439/404
6,315,615	B1 *	11/2001	Raistrick	H01R 12/585 439/637
6,743,053	B2 *	6/2004	Wu	H01R 13/506 439/357
8,152,572	B1 *	4/2012	Liu	H01R 13/432 439/746
8,690,611	B2 *	4/2014	Selvitelli	A61B 5/0416 439/729
2004/0242082	A1	12/2004	Tsuchiya	
2006/0178023	A1 *	8/2006	Matsumura	H01R 43/20 439/76.1
2006/0246786	A1 *	11/2006	Noguchi	H01R 12/585 439/751
2007/0270001	A1	11/2007	Matsumura	
2009/0156044	A1	6/2009	Mito et al.	
2014/0065897	A1 *	3/2014	Kida	H01R 13/41 439/889

FOREIGN PATENT DOCUMENTS

JP	2009-151940	A	7/2009
JP	4924247	B2	4/2012

OTHER PUBLICATIONS

A Japanese office action issued on Oct. 20, 2015 in the counterpart Japanese patent application.

* cited by examiner

FIG. 1

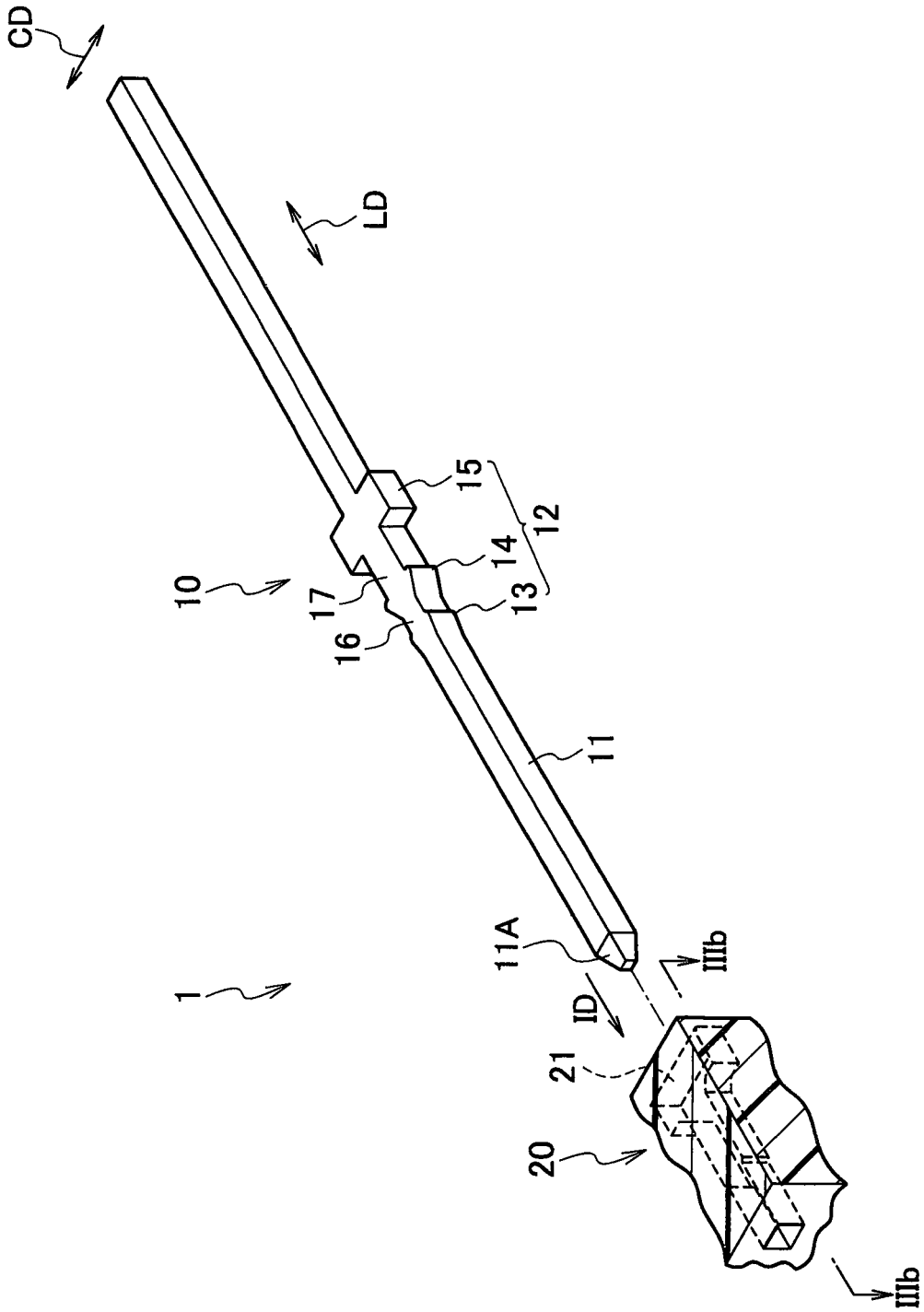


FIG. 2A

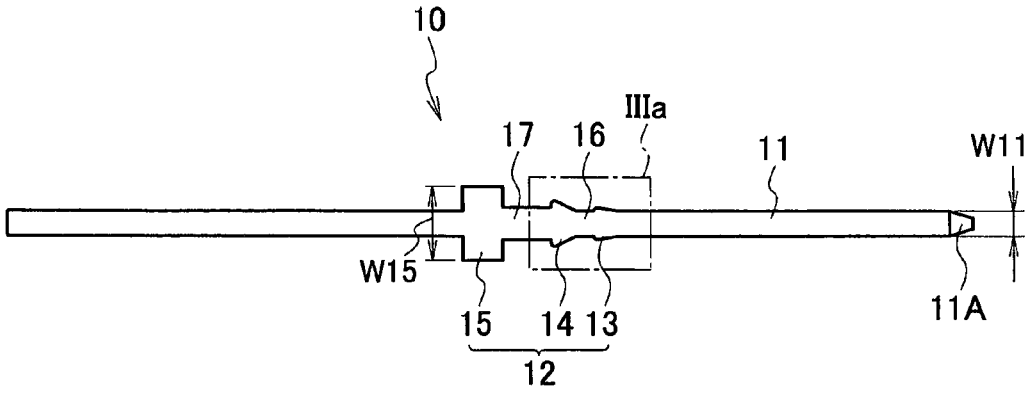

10
IIIa
17
16
11
W11
W15
15
14
13
12
11A

FIG. 2B

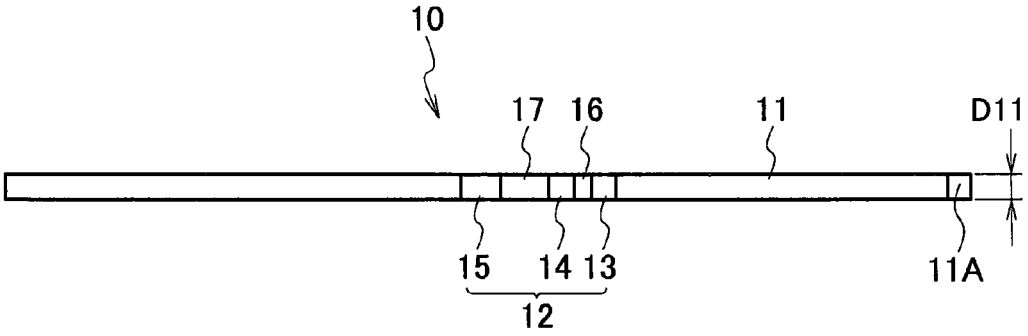

10
17
16
11
D11
15
14
13
12
11A

FIG. 3A

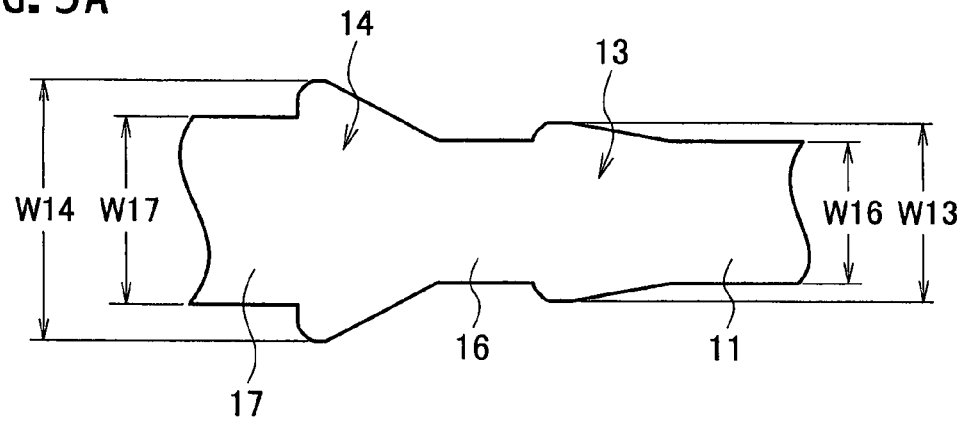


FIG. 3B

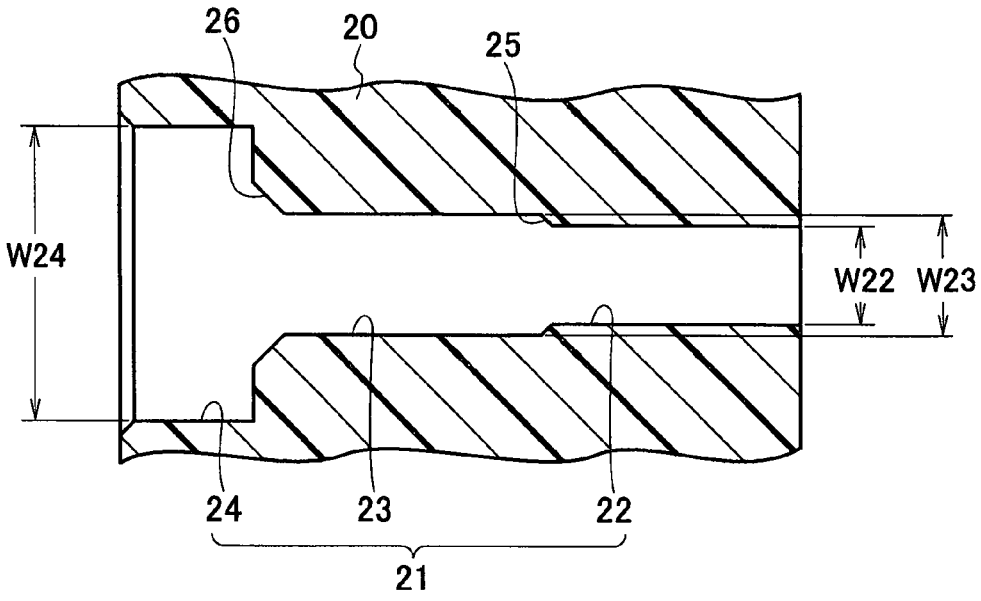


FIG. 4A

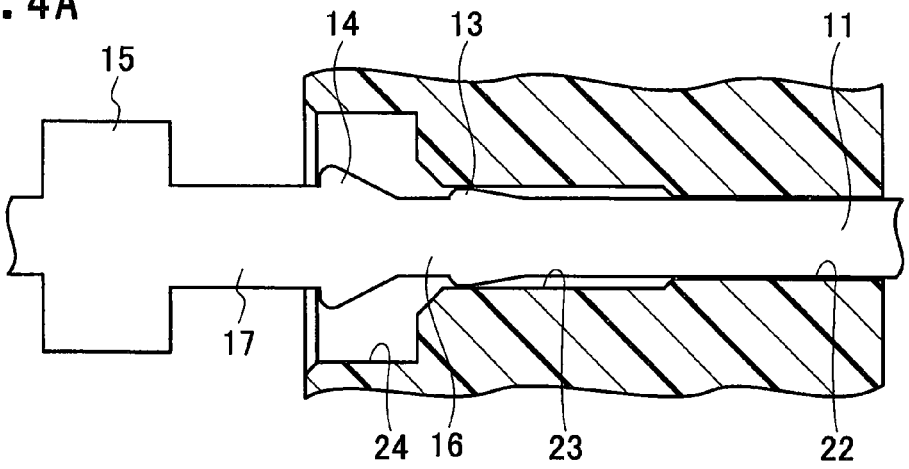


FIG. 4B

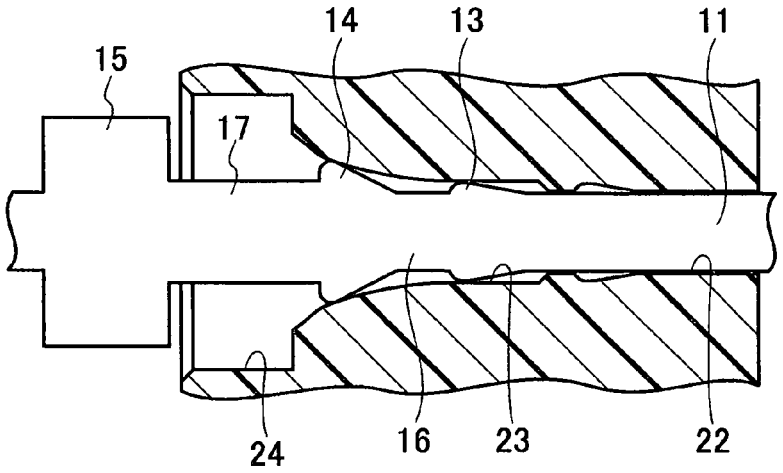


FIG. 4C

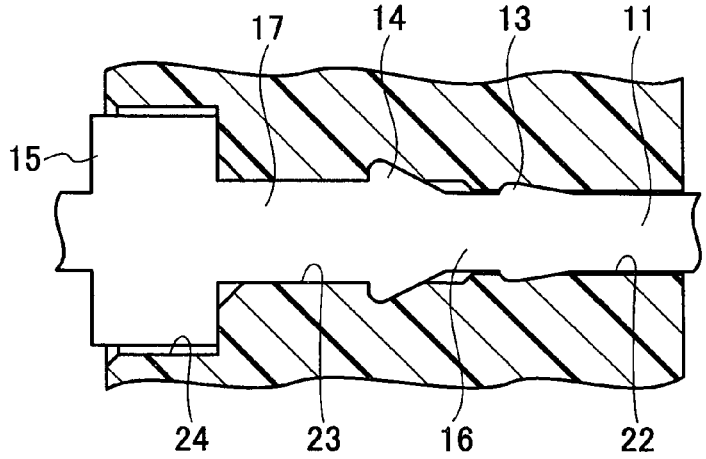
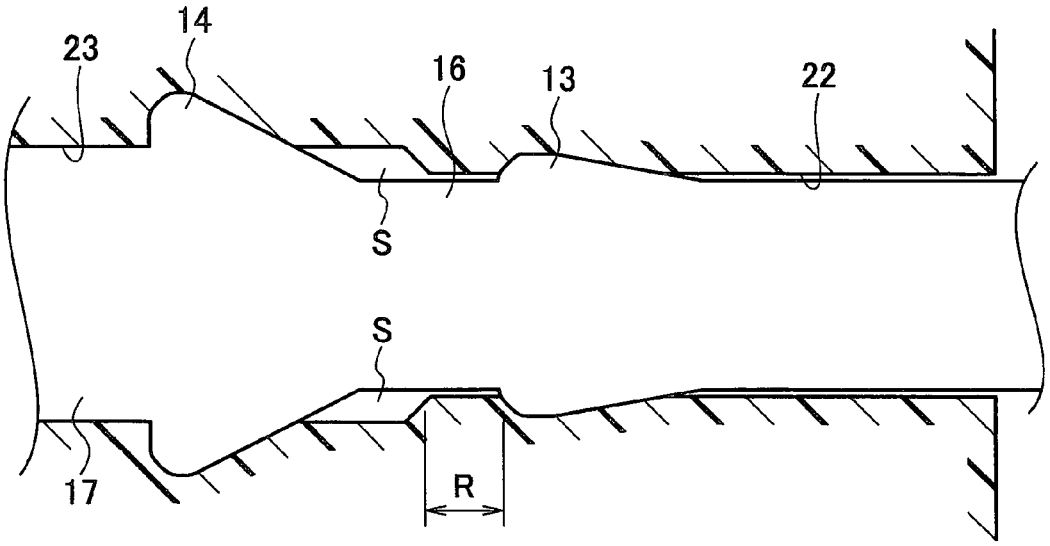


FIG. 5



CONNECTOR

CROSS REFERENCE TO RELATED APPLICATION

This application is a Continuation of PCT Application No. PCT/JP2013/002272, filed on Apr. 2, 2013, and claims the priority of Japanese Patent Application No. 2012-108348, filed on May 10, 2012, the content of both of which is incorporated herein by reference.

BACKGROUND

1. Technical Field

The present invention relates to a connector in which a terminal is press-fitted and held in a terminal holding hole formed in a connector housing.

2. Related Art

There is known a connector which is used for connection of various devices mounted in a vehicle such as a car and is connected to, for example, a PCB (Printed Circuit Board). As a connector of this type, JP 2009-151940 A proposes a connector in which a terminal formed of a square metal wire material is press-fitted and held in a terminal holding hole formed in a connector housing.

Specifically, the above connector has a terminal including, for example, a terminal body and a plurality of press-fitting protrusions protruding outward from the terminal body so as to be press-fitted in a terminal holding hole. A connection portion is provided between the press-fitting protrusions. In general, the connection portion has a size equal to that of the terminal body. In the connector of such a type, the press-fitting protrusions are press-fitted in the terminal holding hole, whereby force of holding the terminal in the terminal holding hole can be maintained.

SUMMARY

In recent years, along with a reduction in a weight of the vehicle, a demand has arisen for a reduction in a size of the connector and, correspondingly, a reduction in the size (including a reduction in a diameter) of the terminal is being done.

However, in the above connector, simply reducing the size of the terminal leads to concentration of stress on the connection portion when the press-fitting protrusions are brought into contact with the terminal holding hole in the course of insertion of the terminal into the terminal holding hole, which may cause buckling of the connection portion.

An object of the present invention is to provide a connector capable of preventing the connection portion in which stress is concentrated upon insertion of the terminal into the terminal holding hole from being buckled.

A connector in accordance with some embodiments includes a terminal made of metal, and a connector housing having a terminal holding hole for the terminal to be press-fitted and held. The terminal includes a terminal body, and a press-fitting protrusion protruding from the terminal body in an orthogonal direction orthogonal to a longitudinal direction of the terminal to be press-fitted in the terminal holding hole. The press-fitting protrusion includes a first protrusion portion, and a second protrusion portion disposed rearward of the first protrusion in an insertion direction of the terminal into the terminal holding hole and protruding father in the orthogonal direction than the first protrusion portion. The terminal has, between the first and the second

protrusion portions, a first connection portion having a width larger than a width of the terminal body.

According to the above configuration, the first connection portion has a width larger than the width of the terminal body. This can prevent the first connection portion from being buckled even if stress is concentrated on the first connection portion due to contact of the first protrusion portion and the second protrusion portion with respect to the terminal holding hole at the insertion of the terminal into the terminal holding hole. Therefore, even when the size of the terminal is reduced, the buckling of the first connection portion is unlikely to occur.

The width of the first connection portion may be larger than a thickness of the terminal body.

According to the above configuration, the width of the first connection portion is larger than the thickness of the terminal body. This further reinforces the first connection portion, with the result that the buckling of the first connection portion becomes more unlikely to occur.

The first protrusion portion may include a front protrusion, and a rear protrusion disposed rearward of the front protrusion in the insertion direction and protruding farther in the orthogonal direction than the front protrusion.

According to the above configuration, the rear protrusion protrudes farther than the front protrusion. This makes it unlikely to increase an insertion load of the terminal into the terminal holding hole, which can improve insertability of the terminal and ensure a force of holding the terminal in the terminal holding hole.

The terminal holding hole may include a front protrusion holding portion for the front protrusion to be press-fitted and held, a rear protrusion holding portion for the rear protrusion to be press-fitted and held, the rear protrusion holding portion being disposed rearward of the front protrusion holding portion in the insertion direction, a second protrusion accommodating portion configured to accommodate the second protrusion portion with the front protrusion and the rear protrusion passed through the second protrusion accommodating portion, the second protrusion accommodating portion being disposed rearward of the rear protrusion holding portion in the insertion direction, a front step portion provided between the front protrusion holding portion and the rear protrusion holding portion, and a rear step portion provided between the rear protrusion holding portion and the second protrusion accommodating portion.

According to the above configuration, the front step portion is formed between the front protrusion holding portion and rear protrusion holding portion, and the rear step portion is formed between the rear protrusion holding portion and second protrusion accommodating portion. With this configuration, spaces are formed rearward of the front step portion and rear step portion in the insertion direction when the terminal is press-fitted and held in the terminal holding hole, which makes it easy for the peripheral wall of the terminal holding hole to be deformed. As a result, the insertability of the terminal is further improved.

The connector may further include a second connection portion provided between the front protrusion and the rear protrusion. A width of the front protrusion holding portion may be equal to the width of the first connection portion, and a width of the rear protrusion holding portion may be equal to a width of the second connection portion.

According to the above configuration, the width of the front protrusion holding portion is equal to the width of the first connection portion, and the width of the rear protrusion holding portion is equal to the width of the second connec-

tion portion. This makes it easier to ensure the force of holding the terminal in the terminal holding hole.

According to the embodiments of the present invention, there can be provided a connector capable of preventing the connection portion in which stress is concentrated upon insertion of the terminal into the terminal holding hole from being buckled.

BRIEF DESCRIPTION OF DRAWINGS

FIG. **1** is a perspective view illustrating a connector according to an embodiment of the present invention.

FIG. **2**A is a plan view illustrating the connector according to the embodiment of the present invention.

FIG. **2**B is a side view illustrating the connector according to the embodiment of the present invention.

FIG. **3**A is an enlarged view of a part IIIa of FIG. **2**A.

FIG. **3**B is a cross-sectional view taken along a line IIIb-IIIb of FIG. **1**.

FIG. **4**A is a cross-sectional view for explaining an assembly process of a terminal and a connector housing according to the present embodiment.

FIG. **4**B is a cross-sectional view for explaining an assembly process of the terminal and connector housing according to the present embodiment.

FIG. **4**C is a cross-sectional view for explaining an assembly process of the terminal and connector housing according to the present embodiment.

FIG. **5** is a partially enlarged view of FIG. **4**C.

DETAILED DESCRIPTION

An embodiment of a connector according to the present invention will be described with reference to the drawings. In the following descriptions of the drawings, the same or similar portions are assigned with the same or similar reference symbols. It should be noted that each drawing is a schematic diagram, and may represent different dimensional ratios and the like from an actual dimensional ratios. Hence, specific dimensions and the like should be determined in consideration of the following descriptions. Furthermore, different drawings include elements which have different dimensional relations and ratios.

Configuration of Connector

First, a configuration of a connector **1** according to the present embodiment will be described with reference to the drawings. FIG. **1** is a perspective view illustrating the connector **1** according to the present embodiment. FIG. **2**A is a plan view illustrating the connector **1** according to the present embodiment, and FIG. **2**B is a side view illustrating the connector **1** according to the present embodiment. FIG. **3**A is an enlarged view of a part IIIa of FIG. **2**A, and FIG. **3**B is a cross-sectional view taken along a line IIIb-IIIb of FIG. **1**.

As illustrated in FIG. **1** to FIG. **3**B, the connector **1** is used for connection of various devices mounted in a vehicle such as a car and is connected to, for example, a PCB (Printed Circuit Board). The connector **1** includes a terminal **10** formed of a square metal wire material and a connector housing **20** having a terminal holding hole **21** in which the terminal **10** is press-fitted and held. The terminal **10** is not necessarily formed of the square wire material, but only needs to be formed of a metal.

Configuration of Terminal

As illustrated in FIG. **1** to FIG. **3**B, the terminal **10** is obtained by applying copper ground plating or a nickel ground plating to a surface of a copper alloy such as brass serving as a base material. The terminal **10** has an elongated shape having a rectangular cross section and assumes substantially a symmetric appearance as viewed from above (see FIG. **2**A).

The terminal **10** has a terminal body **11** and a press-fitting protrusion **12** protruding from the terminal body **11** in an orthogonal direction CD (width direction, in the present embodiment) orthogonal to a longitudinal direction LD of the terminal **10** so as to be press-fitted to a terminal holding hole **21**.

The press-fitting protrusion **12** is constituted by a front protrusion **13** and a rear protrusion **14** which collectively serve as a first protrusion portion and each of which has substantially a triangular shape as viewed from above (see FIG. **2**A) and a press-fitting shoulder portion **15** which serves as a second protrusion portion.

The front protrusion **13** is formed frontward of the rear protrusion **14** in an insertion direction ID of the terminal **10** into the terminal holding hole **21**. The rear protrusion **14** protrudes farther in the orthogonal direction CD than the front protrusion **13**. The press-fitting shoulder portion **15** is formed rearward of the front protrusion **13** and rear protrusion **14** in the insertion direction ID of the terminal **10** and protrudes farther in the orthogonal direction CD than the front protrusion **13** and rear protrusion **14**.

A connection portion **16** serving as a second connection portion is formed between the front protrusion **13** and rear protrusion **14**. A connection portion **17** serving as a first connection portion is formed between the rear protrusion **14** and press-fitting shoulder portion **15**.

The connection portion **16** has a size equal to that of the terminal body **11**. That is, a width W**16** of the connection portion **16** (see FIG. **3**A) is equal to a width W**11** (see FIG. **2**A) of the terminal body **11**. A thickness of the connection portion **16** is equal to a thickness D**11** (see FIG. **2**B) of the terminal body **11**.

The connection portion **17** has a width larger than the width W**11** of the terminal body **11**. That is, a width W**17** of the connection portion **17** is larger than the width W**11** of the terminal body **11** and is larger than the thickness D**11** of the terminal body **11**. A thickness of the connection portion **17** is equal to the thickness D**11** of the terminal body **11**.

Configuration of Connector Housing

As illustrated in FIG. **1** and FIG. **3**B, the connector housing **20** is formed of a resin, etc., and is configured to fix and hold the terminal **10** press-fitted in the terminal holding hole **21**. Although only a part of the connector housing **20** is illustrated in the drawings, the connector housing **20** is configured to be able to be fitted with and detached from a mating connector.

The terminal holding hole **21** formed in the connector housing **20** extends along the insertion direction ID (i.e., longitudinal direction LD of the terminal **10**) of the terminal **10**. As illustrated in FIG. **3**B, the terminal holding hole **21** is constituted by a front protrusion holding portion **22** and a rear protrusion holding portion **23** which collectively serve as a first protrusion accommodating portion and a shoulder accommodating portion **24** which serves as a second protrusion accommodating portion. The front protrusion holding portion **22** holds the front protrusion **13** press-fitted therein. The rear protrusion holding portion **23** holds the rear protrusion **14** press-fitted therein. The shoulder accommodating portion **24** allows the front protrusion **13** and rear

protrusion **14** to pass therethrough and accommodates the press-fitting shoulder portion **15**.

A width W**22** of the front protrusion holding portion **22** is smaller than a width W**13** of the front protrusion **13** and coincides with (is equal to) the width W**16** of the connection portion **16**. A width W**23** of the rear protrusion holding portion **23** is smaller than a width W**14** of the rear protrusion **14** and coincides with (is equal to) the width W**13** of the front protrusion **13** and width W**17** of the connection portion **17**. A width W**24** of the shoulder accommodating portion **24** is larger than a width W**15** of the press-fitting shoulder portion **15**. Thicknesses of the front protrusion holding portion **22**, rear protrusion holding portion **23**, and shoulder accommodating portion **24** are respectively equal to the thickness D**11** of the terminal body **11**.

The above "coincidence" is nominal coincidence and, in the present embodiment, the width W**22** of the front protrusion holding portion **22** is slightly larger (by the size of a clearance) than the width W**16** of the connection portion **16**. Further, the width W**23** of the rear protrusion holding portion **23** is slightly larger than the width W**17** of the connection portion **17**.

A front step portion **25**, which is on a front side of the terminal **10** in the insertion direction ID of the terminal **10**, is formed between the front protrusion holding portion **22** and rear protrusion holding portion **23**. A rear step portion **26**, which is rearward of the front step portion **25** in the insertion direction ID of the terminal **10**, is formed between the rear protrusion holding portion **23** and shoulder accommodating portion **24**. The front step portion **25** is formed by a slope inclined relative to the orthogonal direction CD. The rear step portion **26** is formed by a slope inclined relative to the orthogonal direction CD.

Assembly Process of Terminal and Connector Housing

The following describes an assembly process of the terminal **10** and housing connector **20** with reference to the drawings. FIGS. **4**A to **4**C are cross-sectional views for explaining the assembly process of the terminal **10** and housing connector **20** according to the present embodiment. FIG. **5** is a partially enlarged view of FIG. **4**C.

First, the terminal **10** is inserted, from a leading end **11**A side of the terminal body **11**, into the terminal holding hole **21** formed in the connector housing **20**. At this time, the terminal body **11** is inserted through the shoulder accommodating portion **24**, rear protrusion holding portion **23**, and front protrusion holding portion **22** in this order.

More specifically, as illustrated in FIG. **4**A, when the terminal **10** is inserted into the terminal holding hole **21**, the front protrusion **13** is inserted through the shoulder accommodating portion **24** and positioned in the rear protrusion holding portion **23**, and the rear protrusion **14** is positioned in the shoulder accommodating portion **24**. At this time, the width W**23** of the rear protrusion holding portion **23** coincides with the width W**13** of the front protrusion **13** (see FIGS. **2**A, **2**B, **3**A, and **3**B), so that an insertion load of the terminal **10** is not increased.

Subsequently, as illustrated in FIG. **4**B, when the terminal **10** is further inserted into the terminal holding hole **21**, the rear protrusion **14** is press-fitted in the rear protrusion holding portion **23** in a state where the front protrusion **13** is positioned in the rear protrusion holding portion **23**. At this time, the front protrusion **13** is not press-fitted in the front protrusion holding portion **22** and, thus, a stroke (an increase in insertion load) at the press-fitting of the terminal **10** is reduced, which can prevent the insertion load of the terminal **10** from being increased.

Subsequently, as illustrated in FIG. **4**C, when the terminal **10** is still further inserted into the terminal holding hole **21**, the front protrusion **13** is press-fitted in the front protrusion holding portion **22**, the rear protrusion **14** continues to be press-fitted in the rear protrusion holding portion **23**, and the press-fitting shoulder portion **15** is positioned in the shoulder accommodating portion **24**.

At this time, as illustrated in FIG. **5**, there occurs a space S rearward of the front protrusion **13** in the insertion direction ID to make it easy for the connector housing **20** to be deformed and, thereafter, the front protrusion holding portion **22** is restored after the passing of the front protrusion **13**, whereby the front protrusion **13** is press-fitted and held between inner surfaces of the front protrusion holding portion **22**. Thus, force of holding the terminal **10** in the terminal holding hole **21** can be ensured.

In addition, the width W**17** of the connection portion **17** is larger than the width W**11** of the terminal body **11** and larger than the thickness D**11** of the terminal body **11**, so that it is possible to prevent the connection portion **17** from being buckled due to stress concentrated thereon. Since the connection portion **16** is positioned in the front protrusion holding portion **22**, the connection portion **16** is prevented from being buckled.

Functions and Effects

In the above embodiment, the connection portion **17** has a width larger than the width W**11** of the terminal body **11**. This can prevent the connection portion **17** from being buckled even if stress is concentrated on the connection portion **17** due to contact of the front protrusion **13** and rear protrusion **14** with respect to the terminal holding hole **21** at the insertion of the terminal **10** into the terminal holding hole **21**. Therefore, even when the size of the terminal **10** is reduced, the buckling of the connection portion **17** is unlikely to occur.

In the present embodiment, the width W**17** of the connection portion **17** is larger than the thickness D**11** of the terminal body **11**. This further reinforces the connection portion **17**, with the result that the buckling of the connection portion **17** becomes more unlikely to occur.

In the present embodiment, the rear protrusion **14** protrudes farther in the orthogonal direction CD than the front protrusion **13**. This makes it unlikely to increase the insertion load of the terminal **10** into the terminal holding hole **21**, which can improve insertability of the terminal **10** and ensure the force of holding the terminal **10** in the terminal holding hole **21**.

In the present embodiment, the front step portion **25** is formed between the front protrusion holding portion **22** and rear protrusion holding portion **23**, and the rear step portion **26** is formed between the rear protrusion holding portion **23** and shoulder accommodating portion **24**. With this configuration, the spaces S are formed rearward of the front step portion **25** and rear step portion **26** in the insertion direction ID when the terminal **10** is press-fitted and held in the terminal holding hole **21**, which makes it easy for the peripheral wall of the terminal holding hole **21** to be deformed. As a result, the insertability of the terminal **10** is further improved.

Preferably, a distance R (so-called lap amount) over which the front protrusion **13** moves in the front protrusion holding portion **22** is as long as possible (see FIG. **5**). When the distance R is long, the insertability of the terminal **10** is

reduced, whereas a shear amount is increased to make it easy to ensure the force of holding the terminal **10** in the terminal holding hole **21**. That is, by setting the distance R over which the front protrusion **13** moves in the front protrusion holding portion **22**, the insertability of the terminal **10** and the force of holding the terminal **10** in the terminal holding hole **21** can be controlled.

In the present embodiment, the width W**22** of the front protrusion holding portion **22** coincides with the width W**16** of the connection portion **16**, and the width W**23** of the rear protrusion holding portion **23** coincides with the width W**17** of the connection portion **17**. This makes it easier to ensure the force of holding the terminal **10** in the terminal holding hole **21**.

Other Embodiments

As described above, the scope of the present invention has been disclosed through the embodiment of the present invention. However, it should be understood that those descriptions and drawings constituting a part of the present disclosure do not limit the present invention. From the present disclosure, various alternative embodiments, examples, and operational technologies will become apparent to those skilled in the art.

For example, the embodiment of the present invention may be modified as follows. Specifically, although it has been described that the width W**17** of the connection portion **17** is larger than the thickness D**11** of the terminal body **11**, the present invention is not limited to this, and the width W**17** of the connection portion **17** may be equal to or smaller than the thickness D**11** of the terminal body **11**.

Further, although it has been described that the first protrusion portion includes the two protrusions: front protrusion **13** and rear protrusion **14**, the present invention is not limited to this, and the first protrusion portion may include three or more protrusions. Even in this case, each protrusion can be made to gradually protrude in the orthogonal direction from its front side to its rear side in the insertion direction ID of the terminal **10**. Further, although it has been described that the rear protrusion **14** protrudes farther than the front protrusion **13**, the present invention is not limited to this, and the protruding amounts of the rear protrusion **14** and front protrusion **13** may be equal to each other.

Further, it has been described that the front step portion **25** is formed by the slope inclined relative to the orthogonal direction CD, and the rear step portion **26** is formed by the slope inclined relative to the orthogonal direction CD. However, the present invention is not limited to this, and a configuration may be adopted in which the front and rear step portions **25** and **26** may each be formed by a surface parallel to the orthogonal direction CD, or in which one of the front and rear step portions **25** and **26** is formed by the slope inclined relative to the orthogonal direction CD and the other one thereof is formed by the surface parallel to the orthogonal direction CD.

Further, the width W**22** of the front protrusion holding portion **22** and width W**23** of the rear protrusion holding portion **23** are not limited to those described in the above embodiment, but may appropriately be set.

As described above, the present invention obviously includes various embodiments and the like not described above. Accordingly, the technical scope of the present invention is determined only by the invention elements according to the scope of claims from the viewpoint of the above explanation.

What is claimed is:

1. A connector comprising:
- a terminal made of metal; and
- a connector housing having a terminal holding hole for the terminal to be press-fitted and held,
- wherein the terminal includes
  - a terminal body, and
  - a press-fitting protrusion protruding from the terminal body in an orthogonal direction orthogonal to a longitudinal direction of the terminal to be press-fitted in the terminal holding hole,
- wherein the press-fitting protrusion includes
  - a first protrusion portion, and
  - a second protrusion portion disposed rearward of the first protrusion in an insertion direction of the terminal into the terminal holding hole and protruding farther in the orthogonal direction than the first protrusion portion,
- wherein the terminal has, between the first and the second protrusion portions, a first connection portion having a width larger than a width of the terminal body, and
- wherein the first protrusion portion includes
  - a front protrusion,
  - a rear protrusion disposed rearward of the front protrusion in the insertion direction and protruding farther in the orthogonal direction than the front protrusion, and a second connection portion between the front protrusion and the rear protrusion, the second connection portion having a width equal to the width of the terminal body and having a thickness equal to a thickness of the terminal body in the orthogonal direction
- wherein the terminal holding hole includes
  - a front protrusion holding portion for the front protrusion to be press-fitted and held,
  - a rear protrusion holding portion for the rear protrusion to be press-fitted and held, the rear protrusion holding portion being disposed rearward of the front protrusion holding portion in the insertion direction,
  - a second protrusion accommodating portion configured to accommodate the second protrusion portion with the front protrusion and the rear protrusion passed through the second protrusion accommodating portion, the second protrusion accommodating portion being disposed rearward of the rear protrusion holding portion in the insertion direction,
  - a front step portion provided between the front protrusion holding portion and the rear protrusion holding portion,
  - a rear step portion provided between the rear protrusion holding portion and the second protrusion accommodating portion, and
- wherein a width of the second protrusion accommodating portion is larger than a width of the second protrusion portion.

2. The connector according to claim **1**, wherein
- the front step portion comprises a slope inclined relative to the orthogonal direction, and
- the rear step portion comprises a slope inclined relative to the orthogonal direction.

3. The connector according to claim **1**, wherein at least one of the front step portion and the rear step portion comprises a surface parallel relative to the orthogonal direction.

4. The connector according to claim **1**, wherein the terminal is positioned in inserted relation into the terminal holding hole such that the front protrusion is positioned in

inserted relation through the second protrusion accommodating portion to be positioned in the rear protrusion holding portion, the rear protrusion is positioned in the second protrusion accommodating portion and the width of the rear protrusion holding portion coincides with the width of the front protrusion.

5. The connector according to claim **4**, wherein the terminal is further positioned in inserted relation into the terminal holding hole such that the rear protrusion is positioned in press-fit relation in the rear protrusion holding portion in a state where the front protrusion is positioned in the rear protrusion holding portion but is not positioned in press-fit relation in the front protrusion holding portion.

6. The connector according to claim **5**, wherein the terminal is still further positioned in inserted relation into the terminal holding hole such that the front protrusion is positioned in press-fit relation in the front protrusion holding portion, the rear protrusion is positioned in press-fit relation in the rear protrusion holding portion, and the second protrusion portion is positioned in the second protrusion accommodating portion.

7. The connector according to claim **6**, wherein a space is provided rearward of the front protrusion in the insertion direction such that the connector housing is enabled to be deformed and the front protrusion holding portion is restored such that the front protrusion is held in press fit relation between inner surfaces of the front protrusion holding portion.

8. The connector according to claim **6**, wherein a distance over which the front protrusion moves in the front protrusion holding portion is set as long as possible to control a force of holding the terminal in the terminal holding hole.

9. The connector according to claim **1**, wherein the first protrusion portion include three or more protrusions.

10. The connector according to claim **1**, wherein the terminal is formed of a square metal wire material.

11. The connector according to claim **1**, wherein the terminal comprises a copper alloy base material having a copper ground plating or a nickel ground plating applied to a surface of a copper alloy base material.

12. The connector according to claim **1**, wherein the front protrusion and the rear protrusion of the first protrusion portion each has a substantially triangular shape.

13. The connector according to claim **1**, wherein the width of the first connection portion is larger than the thickness of the terminal body.

14. The connector according to claim **1**, wherein

a width of the front protrusion holding portion is equal to a width of the second connection portion, and

a width of the rear protrusion holding portion is equal to a width of the first connection portion.

15. The connector according to claim **1**, wherein

a width of the front protrusion holding portion is smaller than a width of the front protrusion, and

a width of the rear protrusion holding portion is smaller than a width of the rear protrusion and is equal to the width of the front protrusion.

16. A connector comprising:

a terminal made of metal; and

a connector housing having a terminal holding hole for the terminal to be press-fitted and held,

wherein the terminal includes

a terminal body, and

a press-fitting protrusion protruding from the terminal body in an orthogonal direction orthogonal to a longitudinal direction of the terminal to be press-fitted in the terminal holding hole,

wherein the press-fitting protrusion includes

a first protrusion portion, and

a second protrusion portion disposed rearward of the first protrusion in an insertion direction of the terminal into the terminal holding hole and protruding farther in the orthogonal direction than the first protrusion portion,

wherein the terminal has, between the first and the second protrusion portions, a first connection portion having a width larger than a width of the terminal body, and

wherein the first protrusion portion includes

a front protrusion,

a rear protrusion disposed rearward of the front protrusion in the insertion direction and protruding farther in the orthogonal direction than the front protrusion, and a second connection portion between the front protrusion and the rear protrusion, the second connection portion having a width equal to the width of the terminal body and having a thickness equal to a thickness of the terminal body in the orthogonal direction

wherein the terminal holding hole includes

a front protrusion holding portion for the front protrusion to be press-fitted and held,

a rear protrusion holding portion for the rear protrusion to be press-fitted and held, the rear protrusion holding portion being disposed rearward of the front protrusion holding portion in the insertion direction,

a second protrusion accommodating portion configured to accommodate the second protrusion portion with the front protrusion and the rear protrusion passed through the second protrusion accommodating portion, the second protrusion accommodating portion being disposed rearward of the rear protrusion holding portion in the insertion direction,

a front step portion provided between the front protrusion holding portion and the rear protrusion holding portion,

a rear step portion provided between the rear protrusion holding portion and the second protrusion accommodating portion, and

wherein thicknesses of the front protrusion holding portion, the rear protrusion holding portion, and the second protrusion accommodating portion are respectively equal to the thickness of the terminal body.

17. The connector according to claim **16**, wherein the width of the first connection portion is larger than the thickness of the terminal body.

18. The connector according to claim **16**, wherein

a width of the front protrusion holding portion is equal to a width of the second connection portion, and

a width of the rear protrusion holding portion is equal to a width of the first connection portion.

19. A connector comprising:

a terminal made of metal; and

a connector housing having a terminal holding hole for the terminal to be press-fitted and held,

wherein the terminal includes

a terminal body, and

a press-fitting protrusion protruding from the terminal body in an orthogonal direction orthogonal to a longitudinal direction of the terminal to be press-fitted in the terminal holding hole,

wherein the press-fitting protrusion includes

a first protrusion portion, and

a second protrusion portion disposed rearward of the first protrusion in an insertion direction of the ter-

minal into the terminal holding hole and protruding farther in the orthogonal direction than the first protrusion portion,

wherein the terminal has, between the first and the second protrusion portions, a first connection portion having a width larger than a width of the terminal body, and

wherein the first protrusion portion includes

a front protrusion,

a rear protrusion disposed rearward of the front protrusion in the insertion direction and protruding farther in the orthogonal direction than the front protrusion, and a second connection portion between the front protrusion and the rear protrusion, the second connection portion having a width equal to the width of the terminal body and having a thickness equal to a thickness of the terminal body in the orthogonal direction

wherein the terminal holding hole includes

a front protrusion holding portion for the front protrusion to be press-fitted and held,

a rear protrusion holding portion for the rear protrusion to be press-fitted and held, the rear protrusion holding portion being disposed rearward of the front protrusion holding portion in the insertion direction,

a second protrusion accommodating portion configured to accommodate the second protrusion portion with the front protrusion and the rear protrusion passed through the second protrusion accommodating portion, the second protrusion accommodating portion being disposed rearward of the rear protrusion holding portion in the insertion direction,

a front step portion provided between the front protrusion holding portion and the rear protrusion holding portion,

a rear step portion provided between the rear protrusion holding portion and the second protrusion accommodating portion, and

wherein

a width of the front protrusion holding portion is slightly larger than a width of the first connection portion, and

a width of the rear protrusion holding portion is slightly larger than a width of the second connection portion.

20. The connector according to claim **19**, wherein the width of the first connection portion is larger than the thickness of the terminal body.

* * * * *